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THE DIET OF THE BARN OWL, *TYTO ALBA* (SCOPOLI), IN NAIROBI, KENYA.

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ABSTRACT

The food of the Barn Owl, *Tyto alba* (Scopoli), was studied by the analysis of undigested remains of prey found in regurgitated pellets. About 1200 pellets were obtained from a nest site at Karen (36° 12'E; 1° 21'), in Nairobi, during the period January 1977-July 1979. Analysis of the skeletal remains found in the pellets revealed that rodents made up 63.8% of the diet, with the multimammate rat *Mastomys natalensis* being the principal single species. Anurans made up 18.8%, crociduras 12.7% and birds 4.6% of the tatal prey items. Bats, lizards and invertebrates formed a minor proportion. Thus, diverse and varying quanties of non-rodent prey were taken by Barn Owls at Karen. Consequently, it appears that the owl would readily switch from the preferred rodent prey to other items during difficult periods. The owl seemed to be an opportunistic feeder with a relatively small hunting range and a preference for hunting in open habitats.

INTRODUCTION

The diet and ecology of the Barn Owl, *Tyto alba* (Scopoli), has been extensively studied in southern Africa (Kolbe 1946, Davies 1959, Hanney 1962, Winterbottom 1966, Vernon 1972). In East Africa, Barn Owls are reident and widely distributed in urban and peri-urban areas (Britton 1980), but little detailed research has been carried out on their food. Laurie (1971) investigated their diet in Serengeti National Park (Tanzania) and found that rodents were the principal prey. According to Norris (1972), pellets collected in Nairobi National Park (Kenya) were found to contain a wide range of prey items, with rodents predominating. Apart from vertebrate prey, pellets in Nairobi and Serengeti were found to contain diverse but minor invertebrate prey items.

Apart from the work of Norris (1972), there seems to have been no serious study on the food of Barn Owls in Kenya. The purpose of the present study was to determine the prey taken by a pair of Barn Owls at Karen (36° 12'E, 1° 21'S), 13 kilometres west of Nairobi. Since Karen is near Nairobi National Park, this work supplements the previous study reported by Norris in 1972.

STUDY AREA

Nairobi lies on the northern edge of the Athi-Kapiti plains and at an average elevation of 1770m above sea level. The distribution pattern of rainfall is bimodal, with the long and short rains occurring in the periods March-May and November-December, respectively. The mean annual rainfall is 1048mm, with a maximum of 1077mm and a minimum of 1018mm.

Karen is a residential area with medium human population density. Prior to the establishment of human settlement, the area was covered by a dry type of tropical semi-evergreen forest, with tall trees such as *Croton megalocarpus* and *Shrebera alata* dominating. Greenway (1943) reported that understorey shrubs and lianes are abundant in this type of forest, but the actual number of tree species is quite limited. Except for scattered patches, most of the original forest at Karen has been cleared and replaced with residential plots ranging in sizes from 5 to 7 hectares. A wide range of exotic species of trees, shrubs and herbs have been planted in the plots amongst the remaining native vegetation. Hedges of Kei Apple (*Aberia caffra*), *Cupressus* spp. and other ornamental shrubs enclose the plots.

In Fig. 1, the principal habitats in which Barn Owls are likely to hunt for prey are shown relative to the position of the owls' nest site at Karen. There is a golf course and other areas of open land where various grasses grow, mainly grazing and farmland species. There are also semi-permanent swamps and man-built ponds which serve as breeding sites for amphibians. Typhaceae (bulrushes) and Cyperacae (reeds) overgrowing areas with stagnant water were inhabited by rodents and served as suitable roost sites for many bird species, particularly ploceids. Some plots at Karen had livestock, open paddocks and stables which were attractive to rodents and grain-eating birds.

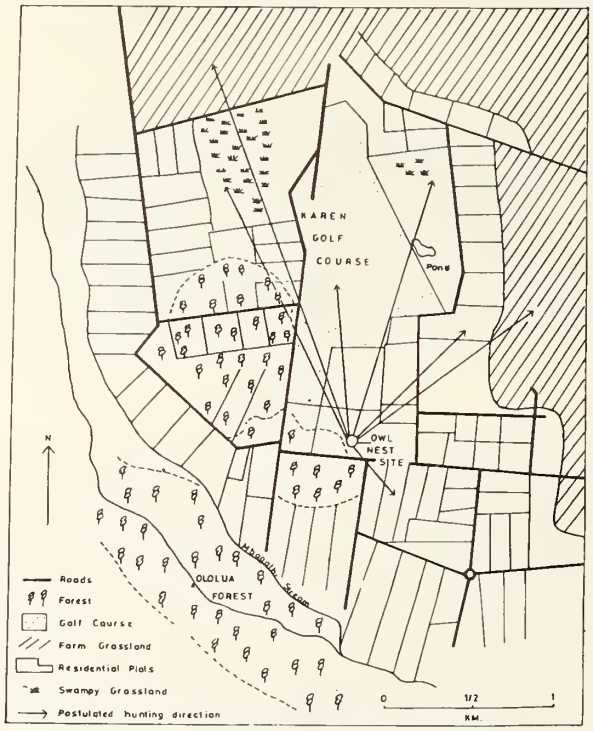

Figure 1. Karen area showing environs of owl's nest site.

MATERIALS AND METHODS

Barn Owl pellets were collected from an attic of an occupied building at Karen during the period January 1977-July 1979. A pair of owls had been intermittently nesting in the attic since 1976. The pellets were not obtained regularly, but were collected during the general cleaning of the house by the owner.

Measurements of complete and compact pellets were taken using sliding calipers, after which the pellets were carefully broken up using a scalpel. The skeletal remains obtained from the pellets were placed in water to which some detergent had been added. After a day, the skeletal material was rinsed in clean water and later bleached in hydrogen peroxide for a period of 24-48 hours. Bleaching of the skeletal material facilitated their identification by comparison with standard museum specimens.

A total of 1200 Barn Owl pellets were obtained from the nest site at Karen. They ranged in size from 49 x 25 mm to 26 x 16 mm, and except for a few loose ones, most of them were coated with dried saliva and were therefore compact. There was a tendency for pellets to contain complete skulls of the prey, however some contained no skulls at all. Some of the pellets analysed contained a single prey item but the bulk of them contained skeletal remains of different prey species.

Out of the 1200 pellets, 4470 prey fragments were recovered, however only 2262 prey items were identified. The balance, consisting of 231 cranial fragments, 1042 right and 935 left mandibles of vertebrate prey, were not identified due to excessive fragmentation and loss of specific diagnostic characters.

Table 1 shows the numerical percentages of the identified prey items and fragments excluding the unidentified material. Rodents were the principal prey, with frogs and shrews making secondary constituents in the diet. The main prey groups will be dealt with in more detail in the following sections.

Prey Group	Number of Items	% total items
Rodentia	1499	66.3
Insectivora	269	11.9
Chiroptera	1	.04
Aves	97	4.3
Reptilia	1	.04
Anura	395	17.5
Arthropoda	+	+
Total	2262	100.1
Note: + = Present but not counted		

Table 1. The composition of the diet of the Barn Owl at Karen, based on identified items and fragments of the major prey groups.

Arthropoda

Some arthropod prey remains were found but were not counted. Insect remains were found in the form of limbs, elytra, mandibles and fragments of the cuticle. There was evidence of termites (Order Isoptera), beetles (Order Coleoptera) and crickets (Order Orthoptera). Some of the insects may have been taken by prey species such as amphibians, shrews and birds that were subsequently killed by the owl.

Anura

Frogs were detected in the pellets by their characteristic astragalus, and by the pelvic and pectoral girdles, but most anurans were identified from skulls. The identity of *Xenopus* spp. was confirmed from the examination of the pelvic girdles. Anurans formed 18.8% of the total prey and, as shown in Table 2, *Hemisus guineensis* was the most common. This species was also common at Karen. It burrows in the ground feeding on the surface at night and appearing in large numbers at the onset of the rains. *Bufo gutturalis* is also widespread at Karen but no specimen was recovered from the pellets. The species is known to be very toxic to mammals (Duff-Mackay pers. common.), and this may also be the case for birds. Because 40.5% of the anuran prey were unidentified (Table 2), the number of species eaten by the owl may have been more than four.

Prey species	Number of items	% total items
Hemisus guineensis	221	55.9
Pyxicephalus delalandii	5	1.3
Ptychadena spp.	1	0.3
Xenopus borealis	8	2.0
Unidentified fragments	160	40.5
	395	100

Table 2. The frequencies of anuran (frog) prey, based on the identified skills, pelvic girdles and the unidentified fragments.

Aves

Bird remains found in the pellets mainly consisted of skulls, skull fragments and feathers. As an overall element of the diet, birds represented 4.3% of the total prey. As shown in Table 3, the bird prey was diverse, with 12 genera identified. Diversity may have been higher if all the bird prey fragments were

identified to species level. Most of the bird genera belonged to the family Ploceidae, which may have been preyed upon whilst in their communal roosts. The skeletal remains of other bird families were occasionally found.

Prey species	Number of items	% total items
Colius spp.	11	10.1
Pycnonotus spp.	2	1.8
Mirafra spp.	1	0.09
Lonchura spp.	6	5.5
Malaenornis spp.	1	0.9
Lanius spp.	1	0.9
Zosterops spp.	1	0.0
Passer spp.	11	10.1
Ploceus spp.	14	12.8
Quelea spp.	13	11.9
Euplectes spp.	5	4.6
Vidua spp.	2	1.8
Unidentified spp.	41	37.6
Total	109	99.8

Table 3. The frequencies of avian prey, based on identified skulls and the unidentified skull fragments.

Chiroptera and Reptilia

Bat and lizard remains were infrequent in the pellets, with only one fragment each. Because of the loss of specific diagnostic characters, I could not identify the fragments further.

Insectivora

Shrews (family Soricidae) were third in abundance among the animals taken by Barn Owls at Karen. They were an easy prey for the owl since they are slow-moving and nocturnal. The bulk of skulls and mandibles of shrews recovered from the owl's pellets were apparently from young animals and were thus difficult to dientify to species level with certainty because according to Dr. Weib Spitzenberger (pers. comm.) the cranial characteristics do not provide a definite diagnosis and external features and measurements are necessary.

Rodentia

Rodents were the commonest prey. Two families, Muridae and Rhizomydae, both with a total of 14 different species, were identified, but there may have been a few rodents species that could not be positively identified. The Muridae formed the greater proportion of the diet of the Barn Owl. A total of 442 skulls (including their mandibles) were recovered from the pellets. The skulls of individual rodent species were of varying sizes, indicating that small rodents of varying ages and sizes were preyed upon by the owl. Table 4 shows the percentage composition of rodent prey taken.

Of the murid rodents that were positively identified from skull and dental characters, *Otomys angoniensis* made up 36.2% of the total number of skulls, *Mastomys natalensis* made up 29.2% and *Dendromus* sp. and *Mus* sp. combined made up 24.7%. Other rodent species made up only 9.9% of the skulls. Howevér, skulls alone would not show a complete picture of the total rodent prey taken.

Prey species	*Number of skulls*	*Total number of items*	*Skulls all items*	*% grand total*
Rattus rattus	1	7	0.2	0.5
Rhabdomys/Lemniscomys spp.	6	40	1.4	2.7
Mastomys natalensis	129	855	29.2	57.0
Dendromus/Mus spp.	109	109	24.7	7.3
Otomys angoniensis	160	325	36.2	21.7
Oenomys hypoxanthus	1	7	0.2	0.5
Dasymys incomtus	1	7	0.2	0.5
Arvicanthis niloticus	12	79	2.7	5.3
Grammomys dolichurus	6	40	1.4	2.7
Pelomys fallax	1	7	0.2	0.5
Tatera spp.	0	7	0	0.5
Tachyoryctes splendens	16	16	3.6	1.1
Total	442	1499	100	100.3

Table 4. The composition of the rodent prey of the barn owl based on (a) skulls alone and (b) all the identified items.

Apart from the skulls, there were 1057 loose mandibles, some of which were similar to those of the identified skulls. Also, there were teeth and other cranial fragments, some of which matched the skulls already identified. As shown in Table 4, combination of whole skulls and loose skulls fragments resulted in an increased number of prey items and gives a better picture of the rodent prey than skulls alone.

When all the identified skeletal fragments are considered *M. natalensis* made up 57.0% of the total rodent prey. This species was widespread in the study area, especially in open grassland and cultivated areas. *Otomys angoniensis* was the next most important rodent species, constituting 21.7% of the total rodent prey. This rodent is crepuscular and inhabits swampy areas, and its habit of feeding in open sites might have made it vulnerable to predation despite of its low density in the study area. *Arvicanthis niloticus* was a common species in grassland and cultivated areas at Karen, but only a few remains of the spies were recovered from the pellets, probably due to its largely diurnal nature.

Dendromus spp. and *Mus.* spp. are small rodents and as many as four skulls were recovered from a single pellet. *Dendromus* spp. were identified from their characteristic grooved incisors, while those of *Mus* spp. are ungrooved and have a notched surface. Because their skulls were gragile, these were excessively fragmented and the incisors were in most cases lacking. Loose teeth might also have been demaged or lost during the cleaning of the material. Without the incisors, only 4 skulls of *Dendromus* spp. and 3 of *Mus* spp. were positively identified. The balance of 102 skulls could have belonged to either genus.

The Root-rat *Tachyoryctes splendens* was common at Karen but it formed a very low percentage of the Barn Owls' diet. Only 16 skulls were recovered from the pellets, and all of them belonged to young animals. An adult Root-rat may weigh up to 250 g (Kingdon 1974), and may therefore be too large for the owl to kill or carry. Creek Rats (*Pelomys fallax*) are both diurnal and nocturnal feeders, and though suitable habitats for them were available at Karen, only one specimen was recovered from the pellets. Similarly, only one specimen of the Rusty-nosed Rat *Oenomys hypoxanthus* was obtained from the Barn Owl pellets. The Swamp Rat (*Dasymys incomtus*) occupied tall grasses growing in and adjacent to semi-permanent swamps at Karen. However, only one specimen of the species was found in the pellets.

Other rodent species of minor importance in th diet included the Black Rat, *Rattus rattus,* probably associated with stables and farm buildings, which was uncommon in the pellets. *Tatera* spp. were uncommon at Karen, but their numbers probably increase in dry periods of the year. A few skeletal parts belonging to this genus were present. Both grass mice *Lemniscomys* spp. are diurnal feeders and were abundant in the Karen area. They were present in the pellets, but could not be identified to species level because the specimens were apparently old and their dental cusps heavily worn out. According to Kingdom (pers. comm.), such old specimens with worn out dental cusps are difficult to differentiate with certainty. However, it is likely that most of the skulls were those of the more common species *Lemniscomys* spp.

DICUSSION AND CONCLUSIONS

The size of the Barn Owl pellets collected at Karen were comparable to those of pellets collected in different localities in southern Africa by Skead (1963) and Vernon (1972). The pellets collected at Karen

tended to contain complete skulls of one or more species, but this appeared to depend on the size of the prey animals. However, as Brooke (1967) reported, not yet pellet contained whole skulls. The skeletal remains of some prey animals, especially *Praomys* spp., *Dendromus* spp. and *Mus* spp. were often so fragmented that only the molar teeth could be detected in the pellets. Similarly, the molar teeth and incisors of young animals were more frequently recovered than whole skulls.

Analysis of the pellets indicated that a wide range of small vertebrates was preyed upon by the owl, which appears to be well adapted to feeding on rodents and shrews that are nocturnal or crepuscular. Other prey groups, notably arthropods, bats, frogs and lizards seem to be supplementary components in its diet. The relative abundance of bird and frog skeletal remains in the pellets implies that Barn Owls readily switch to them if shrews and rodents are not easily available.

The multimammate Rat (*Mastomys natalensis*) is abundant at Karen (Gichuki 1978), and was the dominant single prey item in the diet. The species may have been preferred and easily available in the owl's hunting range. Further, this prevalence may be ascribed to the semi-commensal nature of both this rat and the owl with man. In South Africa (Vernon 1972) and Nigeria (Demeter 1978), the Barn Owl has been reported feeding almost exclusively on the multimammate rat in areas where the latter was abundant and easily available.

The Swamp Rat *Otomys angoniensis* was second in abundance to the Multimammate Rat as Barn Owl prey. Both *O. angoniensis* and *Dasymys incomtus* occupy similar habitats. The two rodent species were present in semi-permanent swamp vegetation and in reeds bordering man-made ponds and dams at Karen. However, only one specimen of *D. incomtus* was recovered from the pellets, compared with 160 specimens of *O. ongoniensis*. Misonne (1963) compared trapping records of the two rodent species with their skeletal remains recovered from Barn Owl's pellets obtained at Kigezi (Uganda) and concluded that *O. angoniensis* displaces *D. incomtus* from its optimum habitat. My study showed a similar situation at Karen where 0.5% of *D. incomtus* and 21.7% of *O. angoniensis* were recorded from Barn Owl's pellets.

A wide range of other rodent species were taken, but in small numbers. Creek Rats (*Pellomys fallax*) and the Rusty-nosed Rat (*Oenomys hypoxanthus*) occupy swampland and forest edges (Delany 1975), but were only minor components in the diet of the owl at Karen. In West Africa, Heim de Balsac and Lomotte (1958) reported that Barn Owls seemed to select against Creeks Rats and Rusty-nosed Rats, though the two species were widespread within its hunting range. The two rat species and the Root Rat (*Tachyoryctes splendens*) may have been selected against by the pair of Barn Owls at Karen. Furthermore, no forest rodents found at Karen, such as *Graphiurus* spp. and *Lophuromys* spp., were recovered from the owl's pellets. It would thus appear that the owl avoided hunting for prey in well wooded areas, preferring less enclosed habitats.

Hunting by the Barn Owl is a function of its food requirements and the difficulties involved in procuring the food. Thus the owl compensates for poor conditions by hunting for a longer period and in a larger range (Smith and Marti 1976). In an Israeli desert, Bodenheimer (1949) estimated Barn Owl hunting range to be 2-25km^2. At Karen, the habitat conditions favour establishment of a rich small mammal fauna, so that there was probably an abundant food supply in the area. Therefore, the hunting range of the owls was likely to be small. From the distribution of the identified prey species, both recovered from the pellets and trapped in the Karen area, it would appear that the hunting range of the pair of Barn Owls was probably not greater than 5km^2. The hunting range of the studied pair of Barn owls may have overlapped with the range of at least two other pairs known to have roosted and nested in the Karen area (Eric Risley, pers. comm.). Competition from the other two pairs and the changes in the abundance and availability of suitable prey may have caused the pair studied to alter their hunting range from time to time.

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